REMARKS

In the above identified office action the examiner has rejected claims 1, 3, 11-14 and 16 under 35 U.S.C. §103(a) as unpatentable over the Japanese abstract 09-165298 in view of Japanese abstract 57-017494. The examiner has concluded that it would have been obvious to modify and optimize the process perimeter limitations as well as the product taught by Japanese abstract '298 with the process parameter limitations as well as the product taught by Japanese abstract '494. Applicant disagrees with the examiner's conclusions and has the following comments.

The single crystal that is the subject of the present invention is a single crystal silicon that does not include a dislocation. With the CZ method of growing the crystal, the single crystal silicon is grown by tilting a pulling direction of a seed crystal at some angle with respect to a <110> crystal orientation.

According to the method of the subject invention, slip dislocations propagate at an angle to an axial direction of the single crystal silicon, and then slip dislocations reach a wall surface of the single crystal silicon and disappear. Therefore, when a diameter of the single crystal silicon in a necking process is reduced to the same degree as the degree of a <100> axis crystal, then any slip dislocations present in a central portion of the crystal can be easily eliminated. As a consequence, a single crystal silicon ingot with a large diameter and a heavy weight can be pulled while maintaining a high yield.

On the other hand, the cited Japanese Abstract 9-165298 ('298) teaches obtaining a single crystal silicon without a dislocation in a <110> crystal orientation. And the method disclosed matches a pulling direction with <110> crystal orientation by the CZ method, then eliminating slip dislocations with a necking process, and after that pulling the single crystal silicon without a dislocation in a <110> crystal orientation.

Thus the Japanese publication does not reach or suggest propagating slip dislocations at some angle to a direction of a pulling axis in a necking process, so that the slip dislocations are reached at a wall surface of a single crystal silicon and are eliminated effectively, as recited in claim 1 herein.

The (cited Japanese Abstract No. 57-17494 ('494) teaches growing a single crystal silicon with the CZ method by tilting a pulling direction of a seed crystal at an angel of 5-10 degrees with

respect to a <110> crystal orientation.

However, the purpose of Japanese publication '494 is to eliminate etch pits from a wafer of compound semiconductors. The subject and the purpose of the present invention differ from those of Japanese Publication '494 and the cited document 2 does not describe eliminating slip dislocations that appears in a pulling step of a single crystal silicon. Also, Japanese Publication '494 does not describe that slip dislocations are propagated at an angle to a direction of a pulling axis in a necking process, so that the slip dislocations are reached at a wall surface of a single crystal silicon and are effectively eliminated.

As now recited in amended claim 1, a <110> crystal orientation is inclined with respect to an axial direction of a seed crystal and a slip dislocation is eliminated in a necking process. Since the slip dislocation can be eliminated without decreasing a diameter of a necking portion to about 2mm or less, for example, all slip dislocations can be removed at a large diameter as large as a conventional <100> axis crystal (to about 6mm, for example).

Thus, dislocations present in the central portion of the single crystal silicon can be easily removed, and it is possible to easily pull a single crystal silicon ingot with a large diameter and a heavy weight.

Thus, the method of claim 1 is not taught or suggested by the prior art of record, and particularly not by Japanese Publications '298 or '494.

As set forth above for the amended claim 1, the subject invention to pull a single crystal silicon ingot by using a seed crystal with a <110> orientation and with an angle is not taught or suggested by Japanese Publication '298 or '494 either individually or in combination. A seed crystal prepared from a single crystal silicon ingot in such a manner is also not taught or suggested.

Also, according to the amended claims 11 and 13, a {220} plane that is used as a diffraction plane when crystal orientation is detected has a parallel positional relationship with {220} plane in another <100> axis crystal or <111> axis crystal. (line 9-17, Pg. 22 of the specification) Therefore, a processing apparatus without modification can be used.

Therefore, it is not necessary, to change the position of an x-ray diffraction apparatus, or to prepare multiple x-ray diffraction apparatuses, or to use a dedicated processing apparatus separately.

Further, the Japanese Publication '494 does not teach or suggest rotational direction with respect to a <110> crystal orientation. Therefore, on cannot achieve the results or properties of the

crystal of the invention as recited in claims 11 or 13.

Applicant hereby requests reconsideration and reexamination thereof.

With the above amendments and remarks, this application is considered ready for allowance and Applicant earnestly solicits an early notice of same. Should the Examiner be of the opinion that a telephone conference would expedite prosecution of the subject application, he is respectfully requested to call the undersigned at the below-listed number.

Respectfully submitted,

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